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UNIVERZITET PRIVREDNA AKADEMIJA U NOVOM SADU  
FAKULTET ZA EKONOMIJU I INŽENJERSKI MENADŽMENT U NOVOM SADU  
Cvećarska 2, 21000 Novi Sad  
tel./faks: 021/400–484, 469–513  
redakcija@fimek.edu.rs

Glavni urednik  
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Sekretar redakcije  
**Katarina Soleša**

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**Marija Sudar**

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# DIGITALIZING EDUCATION AS AN EDUCATIONAL TOOL FOR TEACHING IN EXTRAORDINARY CIRCUMSTANCES

Marković Sanja Anastasija<sup>1</sup>

**Abstract:** *This paper will analyze the implementation of video lectures as a new form of teaching material which could play an important role in situations when it is necessary to adopt online education, as was the case during the global pandemic caused by the SARS-COV-2 virus. In addition to video lectures, our students were given access to a course book and PowerPoint presentations which included voice recordings of the instructor. The students took part in a survey to identify the form of teaching they found to be most useful. The results were analyzed in this paper, and a classification made in an attempt to answer the question of whether video presentations are a sound investment. The prioritization of the criteria on which to base the evaluation of the educational methods included in the teaching process will be carried out using the PIVot Pairwise RElative Criteria Importance Assessment – the PIPRECIA method.*

**Key words:** *multi-criteria decision analysis / PIPRECI / teaching methods / video lectures.*

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<sup>1</sup> Fakultet za primenjeni menadžment, ekonomiju i finansije u Beogradu, Jevrejska 24/1, 11000 Beograd, e-mail: sanja.markovic@mef.edu.rs

## INTRODUCTION

Due to the pandemic caused by the SARS-COV-2 virus (hereinafter Coronavirus), educational institutions had to adapt their teaching in a short time and switch to the online learning system. As Anderson and Matson put it: “The coronavirus pandemic has reshaped education.” (Andersson & Mattsson, n.d.). Other authors have also dealt with distance learning methods and their evaluation (Bekesiene, Vasiliauskas, Hošková-Mayerová, & Vasilienė-Vasiliauskienė, 2021). The choice of learning methods is one of the key issues in emergency situations such as the Coronavirus pandemic. The correct choice of method depends on the satisfaction of the students, achieving adequate results on the final exam, and satisfaction with the service provided by the faculty in extraordinary circumstances. Given that the choice of an adequate method is a very delicate task, considering and respecting the different opinions expressed by students is extremely important. For teaching to be conducted at a high level in conditions that have been unknown to us so far, it is necessary to primarily pay attention to the needs of new generations of students and their life habits (Kaličanin, Brdar & Cogoljević, 2020). It should be borne in mind that online learning systems, no matter how well designed, will never be able to completely replace the “living word”, and that this is in some way an imposed form of education (Teräs, Suoranta, Teräs & Curcher, 2020).

The Faculty of Applied Management, Economics, and Finance from Belgrade, in its course on Microeconomics, has introduced an innovative learning model in the form of video lectures. These are lectures in the form of short documentary films, recorded in high-definition HD format. The video lectures are characterized as dynamic, and with a large number of examples from everyday life. To investigate the justification of the financial investment in this type of teaching, our students had access to a survey from January to June 2021, in which they made comparisons between different learning methods available to them as part of this course. Three learning methods were available to the students during the 2020/2021 academic year:

- video lectures
- a course book
- voice-over presentations.

The course book used is the seminal volume *Principles of Economics* by a Harvard professor N. Gregory Mankiw. The voice-over presentations are in fact PowerPoint presentations which include voice recordings of the instructor, who outlines and explains the most important elements from the course book material included in the presentation.

Defining the list of criteria on which the choice of method should be based is another extremely important step. Therefore, the evaluation criteria for each available method were carefully chosen, and presented to the student population so that they could reach an informed decision regarding which method they found to be most helpful.

Given the fact that these are different types of teaching material, it is necessary to decide on the best method, i.e. the one that is most beneficial to the students. In order to answer this question, it is essential to prioritize the criteria on which the decision on the optimal method is based (Karamaşa, 2021; Pavković, Jević, Jević, Nguyen & Sava, 2021). Decision theory, a special scientific field (Pavličić, 2018; Popović, 2021) within which methods of multi-criteria decision-making (MCDM) have been developed and proposed, is the logical and justified choice in the process of prioritizing criteria for the selection of teaching methods (Ulutaş et al., 2021a, 2021b; 2020; Stanujkić et al., 2021a, 2021b; Karabašević et al., 2021; Özdağoğlu, Keleş, Altınata & Ulutaş, 2021). MCDM is a special field of management science that is developing extremely quickly and which has offered several different methods that can be used for decision making in different areas of business and economy, due to their wide applicability and great practical importance (Nikolić, 2012). Multi-criteria analysis and decision-making are seeing increased use both in the world and in our country (Figueira & Greco, 2012).

The application of the Pivot Pairwise RElative Criteria Importance Assessment - the PIPRECIA method in solving MCDM problems was outlined by Stanujkić, Zavadskas, Karabašević, Smarandache & Turskis (2017). The applicability of this method was illustrated with the help of a numerical examples for evaluating alternatives, including the prioritization of criteria defined based on survey data analysis. The following section of the paper presents the PIPRECIA method, followed by a discussion and conclusion.

## The PIPRECIA method

The PIPRECIA method was developed by Stanujkić et al. (2017) as a modification of the SWARA method developed by Keršulienė, Zavadskas & Turskis (2010). So far, Popović, Milanović & Mihajlović (2018), Jauković Jocić, Karabašević & Jocić (2020), Memiş, Demir, Karamaşa & Korucuk (2020), Vesković et al. (2020), Ulutas et al. (2021a), and others have used this method. Also, Stanujkić et al. (2021c) proposed the application of the PIPRECIA method with gray numbers, which is also adapted for group decision-making. In addition, Ulutaş, Popović, Radanov, Stanujkić & Karabašević (2021b) propose the Plithogenic extension of PIPRECIA. The calculation procedure of this method is presented through the following steps (Stanujkić, Karabašević, Popović & Sava, 2021):

Step 1. Determine the set of evaluation criteria.

Step 2. Set the relative significance  $s_j$  of each criterion, except the first, as follows:

$$s_j = \begin{cases} > 1 & \text{when } C_j > C_{j-1} \\ 1 & \text{when } C_j = C_{j-1} \\ < 1 & \text{when } C_j < C_{j-1} \end{cases}. \quad (1)$$

where:  $C_j$  and  $C_{j-1}$  denote the significance of criterion  $j$  and criterion  $j-1$ , respectively; and  $j \neq 1$ . In the PIPRECA method, the value of  $s_1$  is set to 1, while values of  $s_{j-1}$  belong to the interval  $(1, 1.9]$  when  $C_j > C_{(j-1)}$ , that is, to the interval  $[0.1, 1)$  when  $C_j < C_{(j-1)}$ .

Step 3. Calculate the value of coefficient  $k_j$  as follows:

$$k_j = \begin{cases} 1 & j=1 \\ 2-s_j & j>1 \end{cases}. \quad (2)$$

Step 4. Calculate the recalculated weight  $q_j$ , as follows:

$$q_j = \begin{cases} 1 & j=1 \\ \frac{q_{j-1}}{k_j} & j>1 \end{cases}. \quad (3)$$

Step 5. Determine the relative weights of the evaluation criteria  $w_j$  as follows:

$$w_j = \frac{q_j}{\sum_{k=1}^n q_k}, \quad (4)$$

where  $k$  denotes the number of criteria.

## ANALYSIS OF THE TEACHING METHODS

This section will present the prioritization of the criteria on which the choice of teaching method should be based. The list of sub-criteria whose prioritization will be performed is also given. An overview of the criteria and sub-criteria is given in Table 1.

**Table 1.** *Overview of criteria and sub-criteria*

Criteria	Sub-criteria
$C_1$ Video lectures	$C_{11}$ Clarity
	$C_{12}$ Ease of mastering the material
	$C_{13}$ Examples from practice
	$C_{14}$ Quality of the instructional materials
	$C_{15}$ Availability of materials
$C_2$ Textbook	$C_{21}$ Clarity
	$C_{22}$ Ease of mastering the material
	$C_{23}$ Examples from practice
	$C_{24}$ Quality of the instructional materials
	$C_{25}$ Availability of materials
$C_3$ Voice-guided presentations	$C_{31}$ Clarity
	$C_{32}$ Ease of mastering the material
	$C_{33}$ Examples from practice
	$C_{34}$ Quality of the instructional materials
	$C_{35}$ Availability of materials

Only one decision-maker is involved in the decision-making process. This is meant as an illustration of the simplicity and applicability of the PIPRECIA method in the decision-making process. We will first determine the importance of the teaching methods, based on the survey data. Table 2 shows the obtained results.

**Table 2.** *Determining the significance of the criteria*

Criteria	$s_j$	$k_j$	$q_j$	$w_j$
$C_1$		1	1	0,38
$C_2$	0,90	1,10	0,90	0,34
$C_3$	0,70	1,30	0,69	0,26
			2,59	1,00

The relative weights of the criteria indicate that video lectures and the course book have the greatest importance, while the least importance is assigned to voice-guided presentations.

As can be seen from Table 1, each criterion was evaluated on the basis of several sub-criteria, and in the next phase of analysis, the relative importance of the sub-criteria related to the corresponding criterion will be determined, as shown in Tables 3-5.

Table 3 contains the relative weights of the sub-criteria aimed at using video lectures as teaching material.

**Table 3.** *Relative weights of the sub-criteria - video lectures*

Sub-criteria	$s_j$	$k_j$	$q_j$	$w_j$
$C_{11}$		1	1	0,19
$C_{12}$	1,10	0,90	1,11	0,21
$C_{13}$	1	1	1,11	0,21
$C_{14}$	0,90	1,10	1	0,19
$C_{15}$	1	1	1	0,19
			5,22	1,00

Among the sub-criteria related to video lectures, the most important were sub-criteria  $C_{12}$  - ease of mastering the material and  $C_{13}$  - examples from practice, while the same importance was given to sub-criteria  $C_{11}$  - clarity,  $C_{14}$  - the quality of the instructional material, and  $C_{15}$  - availability of materials.



Table 4 contains the relative weights of the sub-criteria related to the use of the course book as a teaching material.

**Table 4.** *Relative weights of the sub-criteria – course book*

Sub-criteria	$s_j$	$k_j$	$q_j$	$w_j$
$C_{21}$		1	1	0,22
$C_{22}$	1	1	1	0,22
$C_{23}$	0,90	1,1	0,90	0,19
$C_{24}$	0,85	1,15	0,78	0,17
$C_{25}$	1,10	0,90	0,86	0,19
			4,54	1,00

In the sub-criteria related to the course book, sub-criteria  $C_{21}$  - clarity and  $C_{22}$  - ease of mastering the material were singled out as the leading ones, while sub-criterion  $C_{24}$  - the quality of the instructional material was singled out as the worst.

Table 5 shows the relative weights of the sub-criteria aimed at using voice-guided presentations.

**Table 5.** *Relative weights of the sub-criteria – voice-guided presentations*

Sub-criteria	$s_j$	$k_j$	$q_j$	$w_j$
$C_{31}$		1	1	0,22
$C_{32}$	0,95	1,05	0,95	0,21
$C_{33}$	0,60	1,40	0,68	0,15
$C_{34}$	1,20	0,80	0,85	0,19
$C_{35}$	1,10	0,90	0,94	0,21
			4,42	1,00

The sub-criteria related to voice-guided presentations, which stood out as important, are  $C_{31}$  - clarity and  $C_{32}$  - ease of mastering the material, while the biggest objection relates to sub-criterion  $C_{33}$  - examples from practice.

By multiplying the defined local significance of the criteria and the defined sub-criteria, the global significance of the sub-criteria was calculated (Table 6).

**Table 6.** *The global significance of the sub-criteria on which the choice of criteria should be based*

Criteria	Significance	Sub-criteria	Local significance of the sub-criteria	Global significance of the sub-criteria
C <sub>1</sub>	0,38	C <sub>11</sub>	0,19	0,07
		C <sub>12</sub>	0,21	0,08
		C <sub>13</sub>	0,21	0,08
		C <sub>14</sub>	0,19	0,07
		C <sub>15</sub>	0,19	0,07
C <sub>2</sub>	0,34	C <sub>21</sub>	0,22	0,07
		C <sub>22</sub>	0,22	0,07
		C <sub>23</sub>	0,19	0,06
		C <sub>24</sub>	0,17	0,05
		C <sub>25</sub>	0,19	0,06
C <sub>3</sub>	0,26	C <sub>31</sub>	0,22	0,06
		C <sub>32</sub>	0,21	0,05
		C <sub>33</sub>	0,15	0,04
		C <sub>34</sub>	0,19	0,05
		C <sub>35</sub>	0,21	0,05

## DISCUSSION

The obtained results indicate that the greatest weight, and therefore the greatest importance, is assigned to sub-criteria that are directly related to the video lectures (C<sub>1</sub> - 0.38). In addition to the video lectures, the criterion related to the use of the course book (C<sub>2</sub> - 0.34) is of great importance, because the book provided students with the best insight into the material and enabled them to master it more easily. From the group of sub-criteria related to criterion C<sub>1</sub> or the video lectures, the most important are sub-criteria C<sub>12</sub> - ease of mastering the material and C<sub>13</sub> - examples from practice, which justifies the effort invested in the recorded material in which the majority insisted on real-life examples, because it turned out that students master material the best when economic concepts are connected with everyday life familiar to them. The criterion that has the least weight is the one related to voice-guided presentations (C<sub>3</sub>).

If we look at the global importance of sub-criteria, we can also conclude that those from group  $C_1$  were assigned the greatest importance, especially sub-criteria  $C_{12}$  - ease of mastering the material and  $C_{13}$  - examples from practice. In this case, too, the least importance is attached to the sub-criteria from group  $C_3$ . The probable cause of such a poor result lies in the fact that the surveyed students characterized the PowerPoint presentations as quite static, especially if we take into account the lifestyle and habits of today's students. Although each presentation is adequately explained and accompanied by examples, it cannot hold the students' attention and they lose focus. As a consequence, insufficient attention is paid to examples and explanations, and the teaching is reduced solely to reading the basic concepts from the slide, which is insufficient for the material to be mastered adequately.

## CONCLUSION

Using the PIPRECIA method in this paper, we prioritized the criteria for assessing the teaching material that was available to the students attending the Microeconomics course by means of online classes during the Coronavirus pandemic. The students had three types of teaching materials at their disposal: a course book, voice-guided presentations, and video lectures, which they evaluated at the end of the semester through a survey that was offered to them. Video lectures were introduced as an innovative model of learning. It turned out that the students who opted for this type of learning mastered the material most easily and achieved high results on their final exam. By evaluating the criteria and sub-criteria, as well as their evaluation presented in this paper, we came to the same results. Thus, we wanted to point out the justification of the invested funds, both material and those related to the time, effort, and engagement on the part of the teachers who were required to prepare this type of teaching material, and thus encourage the digitization of other courses. Therefore, the conclusion is that we can significantly facilitate learning for students in situations such as this one (the COVID-19 crisis), but also for those students who, due to reasons of employment or for other reasons, are committed to accredited programs based on the distance learning system (DLS). In addition, we would provide the today's generations with a completely new, modern, and far more dynamic form of learning, which

is more in line with their way of life and interests, and through the model of connecting courses with everyday life, bring them closer to the course material, enable better understanding, easier application in practice, and exclude rote learning and memorization.

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